HYDROMODELING

Science for the 21st Century

will include advances in the use of supercomputers to create hydrological models that simulate oceans, rivers and streams and allow researchers to explore crucial national and global water management issues

Earth's climate is controlled by a complex interaction of many physical systems, including the atmosphere, oceans, sea ice, land surface and the biosphere. The oceans are of key importance in understanding climate, because changes in ocean circulation patterns are important in determining climate variability on time scales of decades to centuries. Deep ocean currents, for example, create a type of global conveyor belt that transports huge amounts of heat around the world. These ocean currents have the potential to affect significant climate change because of the intimate relationship between the ocean and the atmosphere.

Using Los Alamos' Parallel Ocean Program, scientists have completed a one-tenth-degree — the measure refers to angular spacing between grid points along the equator — computer simulation of the North Atlantic Ocean using available wind surface data from 1985 to 1995. Computer simulations help scientists learn how oceans interact and develop a better understanding of global-scale circulation patterns.

Because Los Alamos is located in the semiarid southwestern U.S., scientists also are aware of the importance of water management. They have used Los Alamos supercomputers to create a model of water resources in the Rio Grande Basin, and recently completed their first soil moisture maps of the Upper Rio Grande Basin. Research so far has focused mainly on land surface and atmospheric interactions.

Los Alamos is part of a consortium led by the National Science Foundation and the University of Arizona collaborating on a five-year, $16 million project to develop a virtual watershed laboratory where scientists can conduct experiments on simulated watersheds that faithfully reflect the physics of real watersheds.

The collaboration will allow scientists to test hypotheses by manipulating variables such as population and analyzing the effects of these changes on dependent variables such as soil moisture and water flow.

Scientists also can attempt to answer questions about how watersheds are affected by climate changes, population growth and changes in water allocation systems that de-emphasize agriculture. The research will help water management experts advise policy makers who will set water use priorities for present and future generations.

By providing researchers a computing environment in which to conduct these simulations, The National Science Foundation Science and Technology Center, in conjunction with Los Alamos scientists, also hope to make the general public more "hydrologically literate" and expand people's understanding of the water supply.

CONTACT: Steve Sandoval at steves@lanl.gov or (505) 665-9206. For more "Science for the 21st Century," go to http://www.lanl.gov/orgs/pa/science21 on the World Wide Web.